



***Forest Fire Case Study (ID)
DMCC Working Group, APAN44th
, Hongkong 2017***

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Firewatch in Forestry

- Initiated by Ministry of Forestry in the early 2001
- In 2009 collaboration between Indonesia and Australia (Landgate) for reducing the fire and hazard smoke
 - Ministry of Forestry , Ministry of Environment and Indonesia National Institute of Aeronautics and Space (LAPAN)
 - Australia , LANDGATE
- Deliver the Data from satellite through Network (Inherent/NREN in 2010 – 2012)
 - Ministry of National Education
- In 2014
 - Burning from the Land in Sumatra and Kalimantan causes the smoke to other country
- In 2015
 - Burning from the peatland effected half of the world



Firewatch Initiatives

- Ministry of Forestry and LAND-gate Australia
 - MODIS-Data from NASA
- Collaboration Ministry Forestry with Ministry of Education (2010) for delivering the Hotspot information (Fire) through the Inherent (University of Palangkaraya and University of Riau)
- In 2015, ITB initiatives again for firewatch
 - Data Analysis through satellite
 - Socialize the environment impact through the social media (Facebook/twitter)
 - Prevent air filter system solution in classroom
- In 2016
 - Prevent initiatives for building the near realtime model with Authomatic Weather System and Environment Sensor

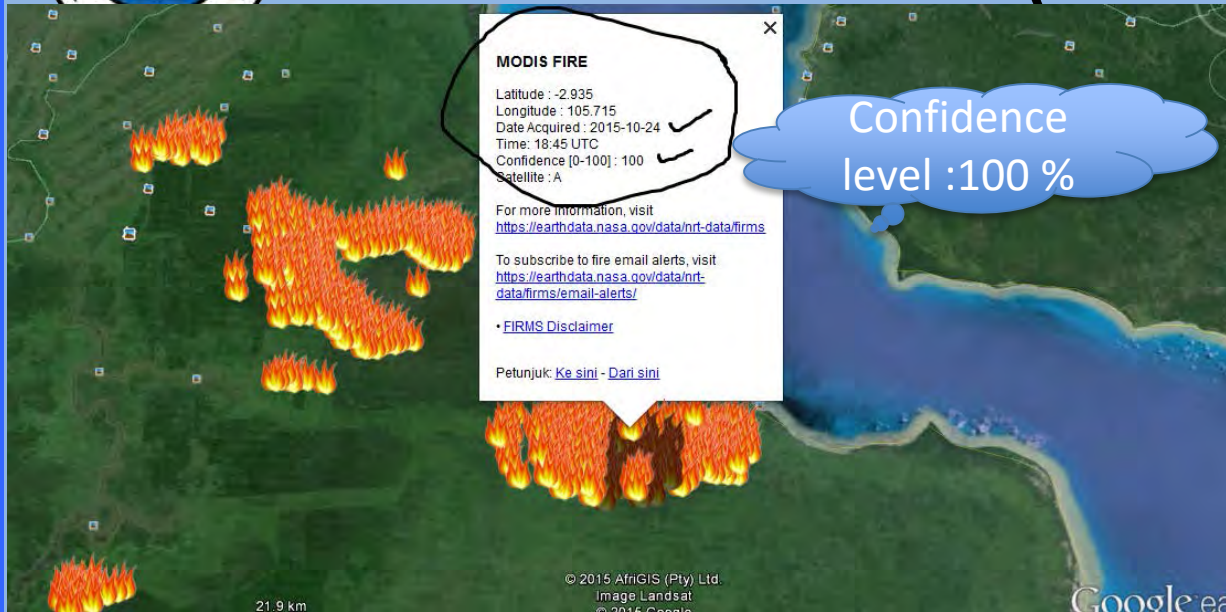


Background

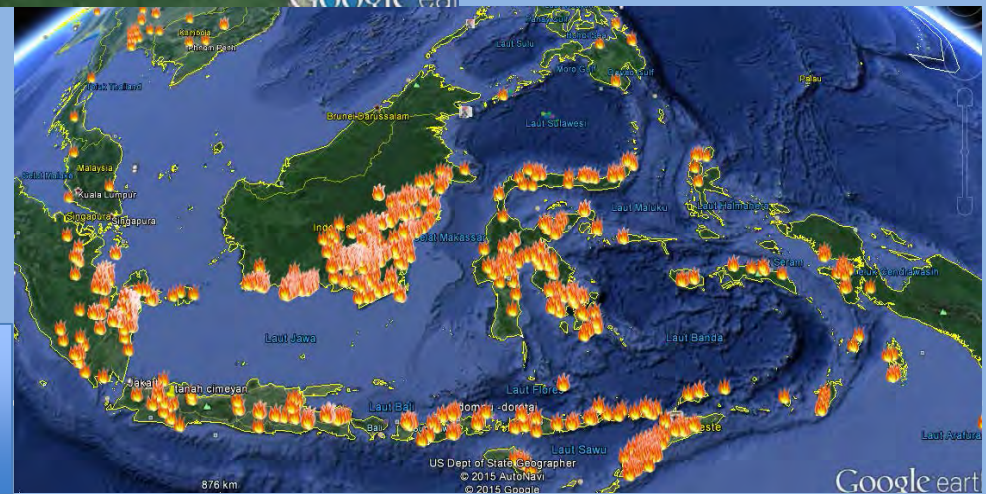
- Fire in the forestry
 - No AWS
 - No sensor connected
 - The MODIS Data came from satellite, within 24 hours
 - Visible Infrared Imaging Radiometer Suite (VIIRS) 375 m
 - Land Clearing on Coconut palm oil plantation
 - More than 10 Million Hectar on Indonesia



Google with KML's data from MODIS NASA (2015)



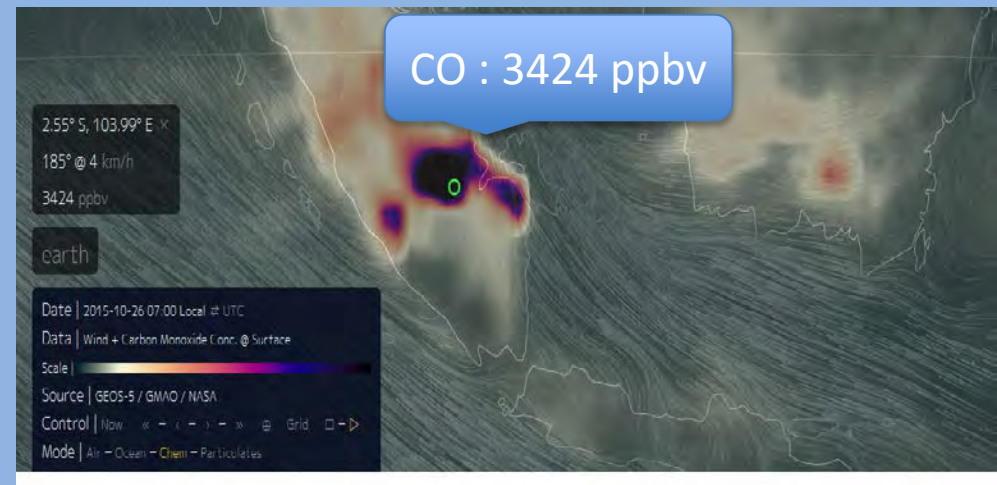
<https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/active-fire-data>





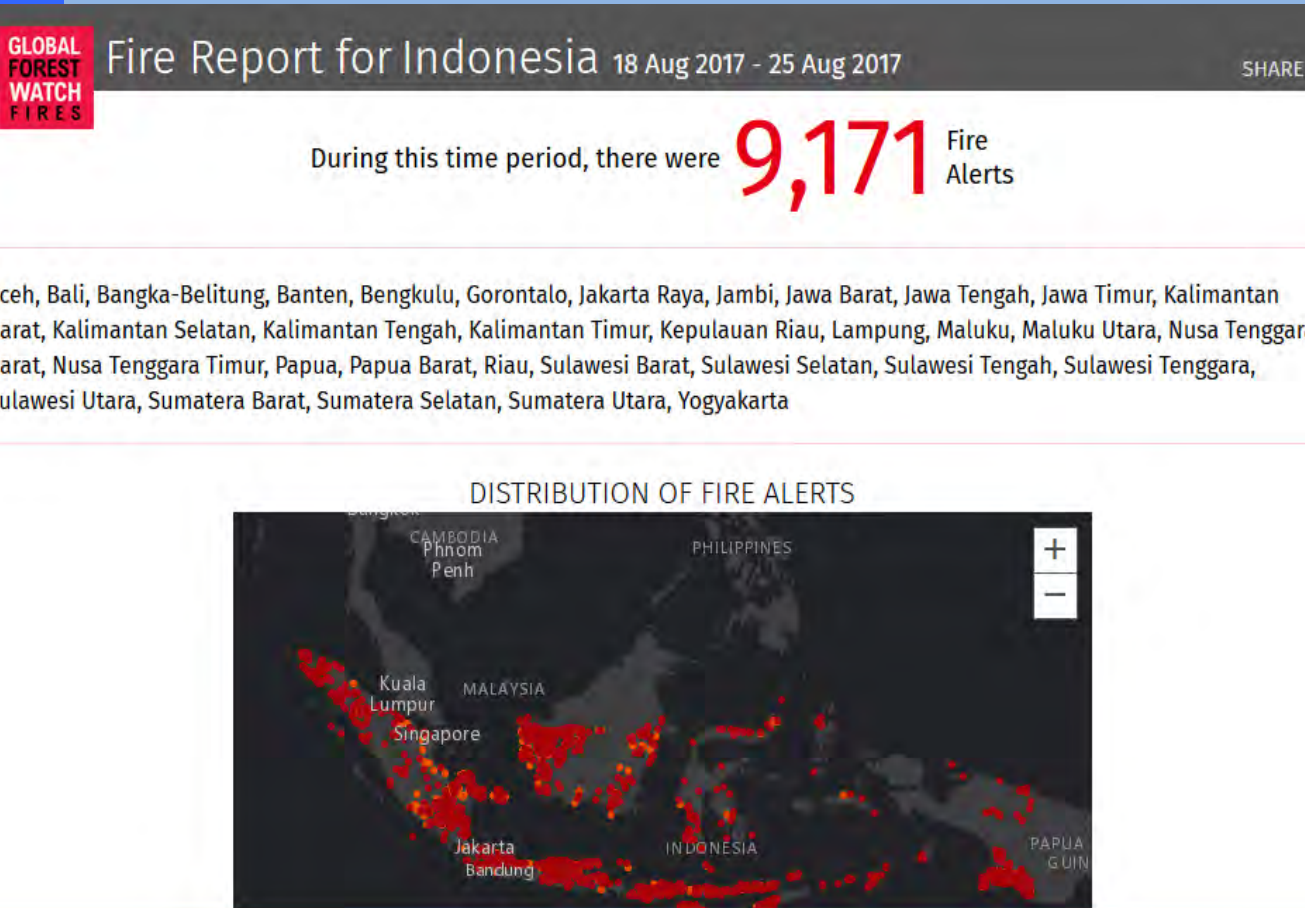
Earth.nullschool.net (2015)

- The Fire affected by the Wind direction and speed
- The indicators :
 - COsc , Carbon Monoxide surface concentration
 - Wind directions and speed
- a visualization of global weather conditions forecast by supercomputers updated every three hours
- Good as a models
- Need more precise informartion on the location affected





Global Firewatch



- Special report for Indonesia (everyday) → 18-25 August 2017



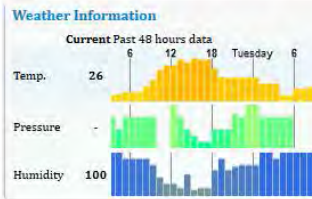
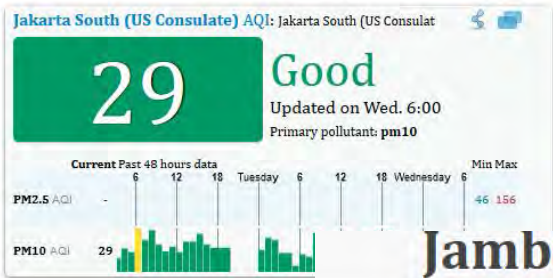
PM2.5 and PM10 sensor

Share Like Share 13K Tweet G+ 266 Share 5 13:06

Jakarta South (US Consulate) Air Pollution: Real-time Air Quality Index (AQI)

JAKARTA SOUTH (US CONSULATE) | JAKARTA CENTRAL (US CONSULATE) | JAKARTA | CIBEUREUM | PALEMBANG | JAMBI

LOCATE THE NEAREST CITY | SEARCH FOR YOUR CITY



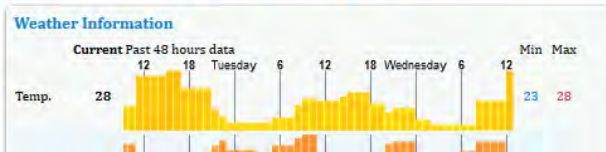
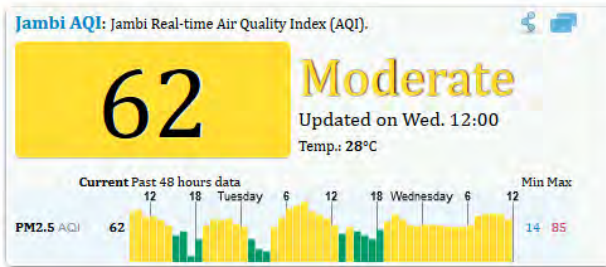
Jambi Air Pollution: Real-time Air Quality Index (AQI)

JAMBI | PALEMBANG | BATAM | PEKANBARU | JAKARTA | JAKARTA CENTRAL (US CONSULATE)

LOCATE THE NEAREST CITY | SEARCH FOR YOUR CITY

It seems that you are not located in **Jambi**, and that the closest city from your location is **India**. Do you want to see the Air Quality Index for **India** instead?

ok No thank you.

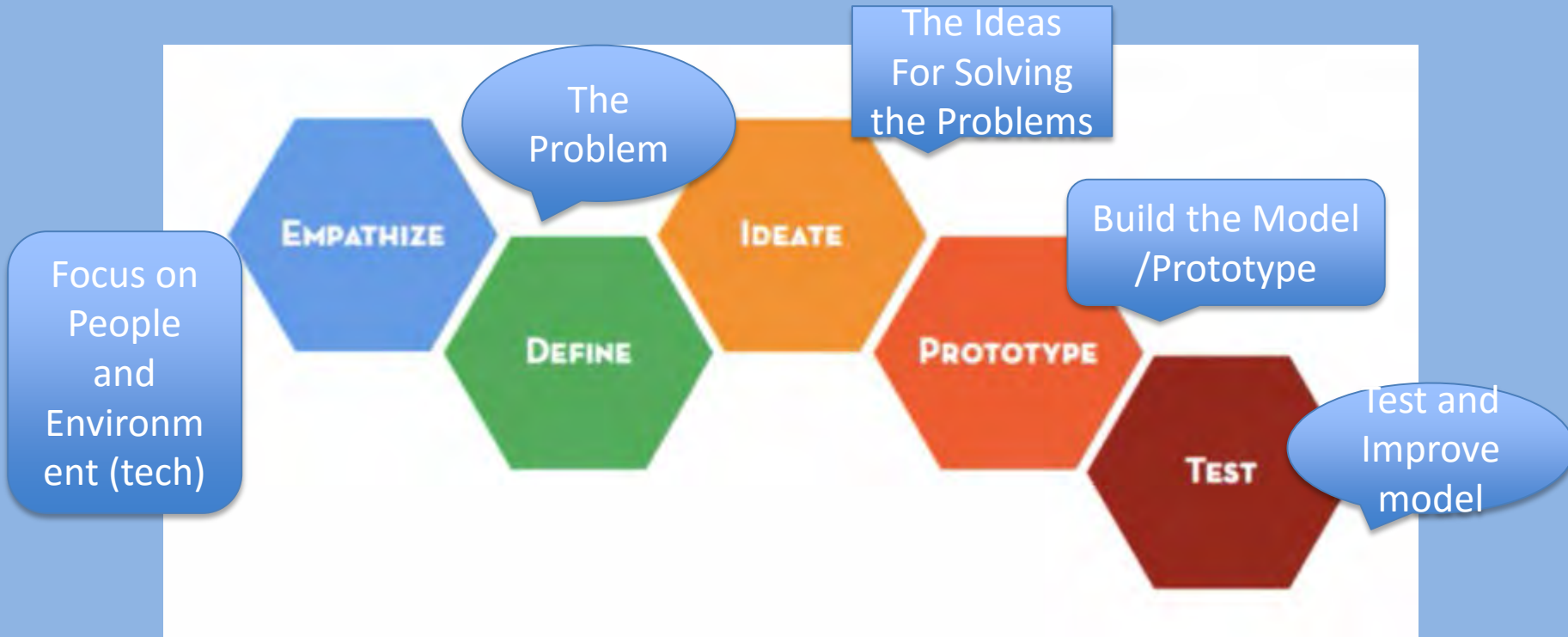


Data : API

<http://aqicn.org/city/indonesia/jakarta/us-consulate/south/>



Concept (Design Thinking)



<http://dschool.stanford.edu/>



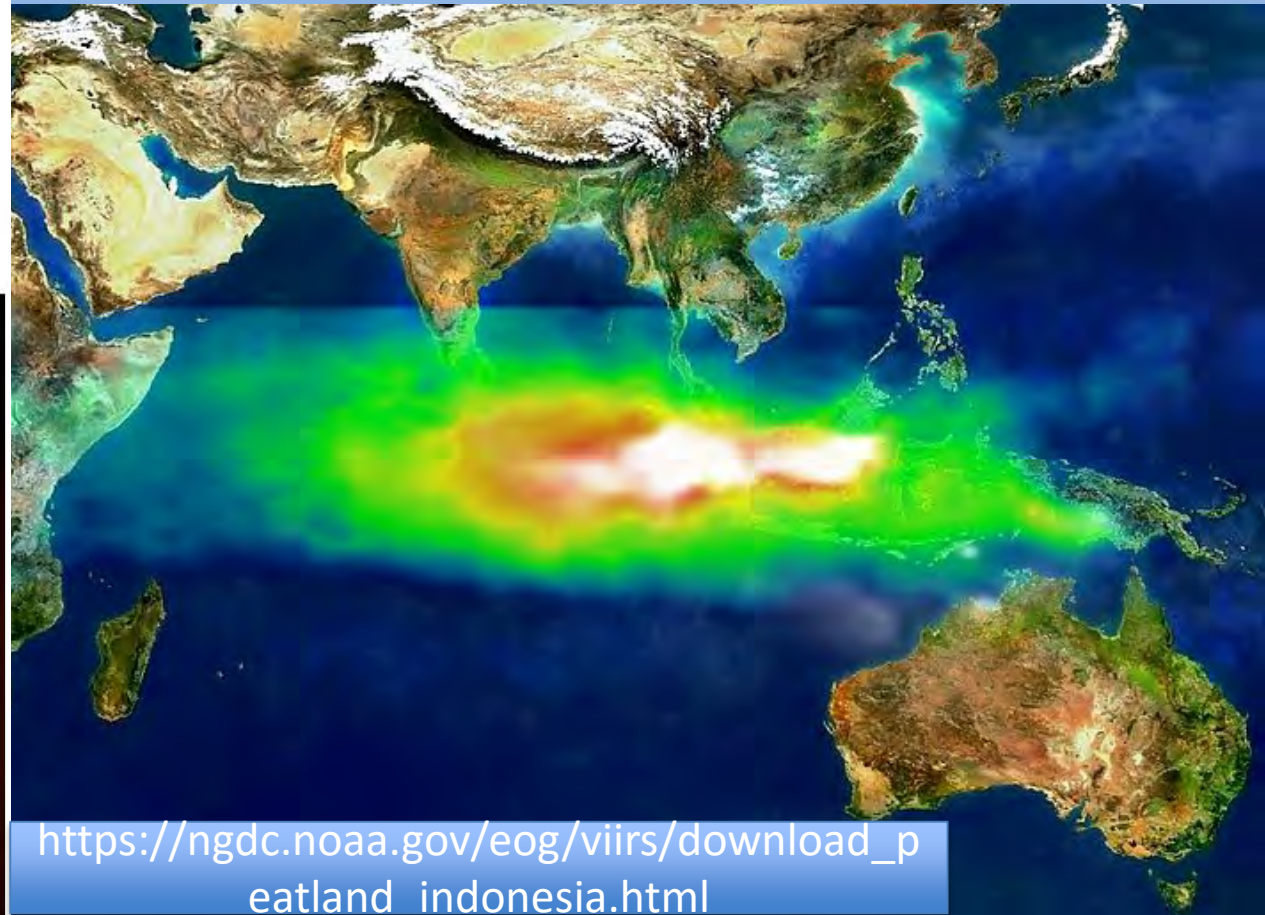
New Scientist (1 August 2016)

HOME NEWS TECHNOLOGY SPACE PHYSICS HEALTH EARTH HUMANS LIFE TOPICS EVENTS JOBS



DAILY NEWS 1 August 2016

Indonesian fires sent huge smoke plume halfway around the globe



https://ngdc.noaa.gov/eog/viirs/download_p_eatland_indonesia.html

https://www.newscientist.com/article/2099496-indonesian-fires-sent-huge-smoke-plume-halfway-around-the-globe/?utm_medium=Social&utm_campaign=Echobox&utm_source=Facebook&utm_term=Autofeed&cmpid=SOC%7cNS%7c2016-Echobox#link_time=1470082665



Define

- What we (Indonesia) need it ?
 - Automated Weather Station
 - Rainfall
 - Temperature
 - Humidity
 - Air quality Index and Pollution Standard index measurements
 - NO_x, SO_x , CO , NH₃ , O₃ and PM 2.5 (10)
 - Sensors and sensors network
 - Prediction models
 - Socialize to peoples
 - Appropriate Technology for the Peoples



IDeate

- By combining the **satellite data** with **meteorological records**, Field established that Indonesian fires often occur in association with the ultra-dry conditions in the region that accompany El Niño, a major cyclical weather system. These dry out the underlying peat to the point at which it can catch fire and can't be extinguished until monsoon rains arrive months later. A next step might be to refine the predictions further by including the combined effects of **high temperatures and low humidity** on peat moisture, says Field.
- He also found that less than **4 millimeters of rain per day** during the annual dry season, from August to November – combined with El Niño conditions – seems to be a “tipping point” beyond which fires can suddenly take off.



Constraints/obstacle

- In the field
 - There is no power
 - Limited coverage by telecommunications system
 - No sensor available
- Source of the fire
 - More than 50 km from nearest



Build Prototype

- Build prototype for AWS+sensor base on Arduino
 - Board (I/O)
 - Communication
 - GSM/GPRS/Wifi
 - Ethernet
 - USB/Storage System
 - Sensors
 - Temperature
 - Wind speed
 - Wind direction
 - Humidity
 - Rainfall rate
 - CO
 - Particulate Matters 2.5 and 10 Micron
 - CH4 ?
- Develop Service Oriented Services (SOA) for the
- Put the AWS in the area with near forestry/ peatland

Prototype 1.0 (2017)



Forestry (School)

Arduinno
Microcont
roller

GSM/GPRS
Modul

TCP/IP

ITB
Web Server
For collecting data
And
Portal

GPS
modul

USB /Storage

CO sensor
And other
sensors

Network of
Science
Community

Middle Ware

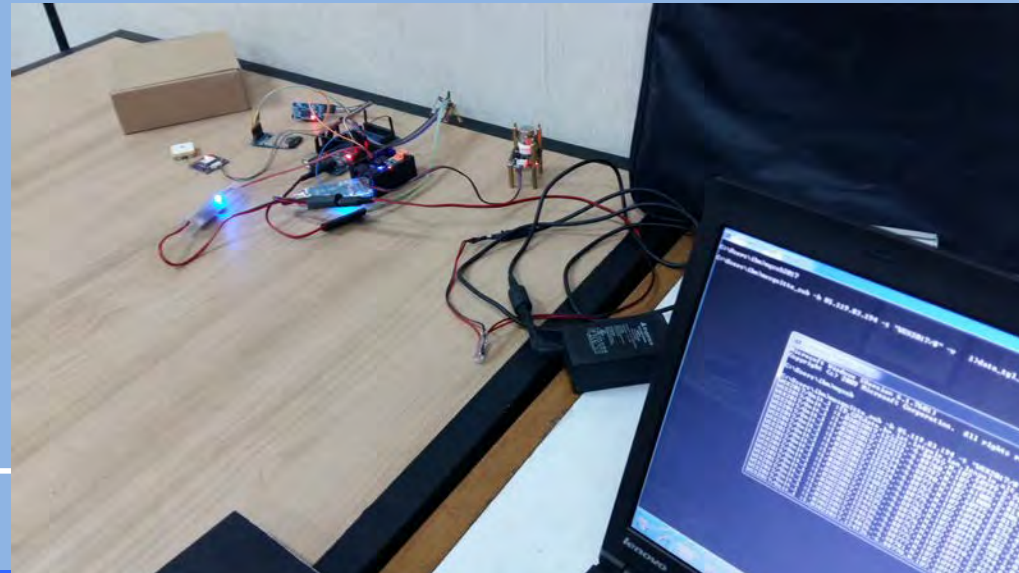
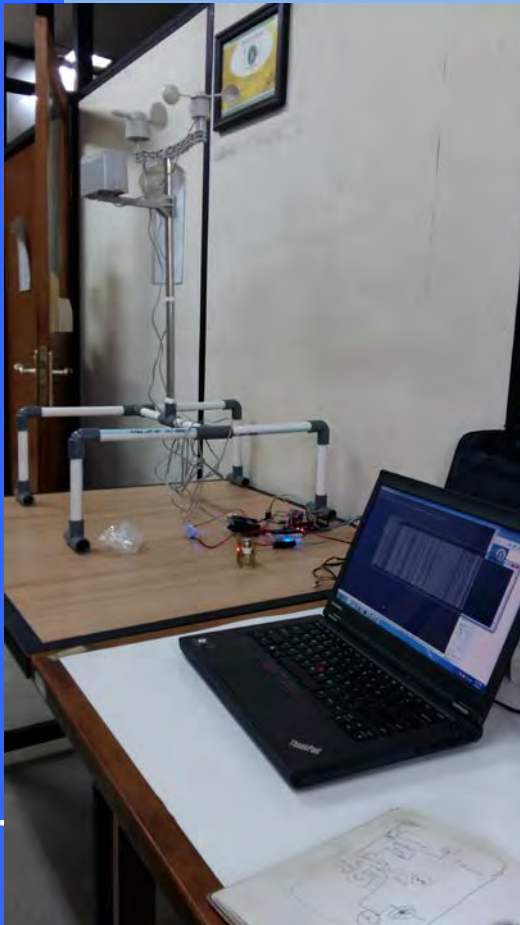
NASA/NOAA
web server ,etc

- AWS
- Wind Direction
- Wind speed
- Temperature
- Humidity
- Rain fall



Testing on the Lab

- AWS
 - Windspeed, wind direction, temperature, pressure, humidity, CO2 sensor ,etc
 - GSM /GPRS





ground

time (GMT), alt,
temp, wind
speed,

humidity,
CO2, CH4

IoTserver
gateway (WSO2)



Stream Data to server

- Data :
 - Per minutes
 - Push the data to the IOT server

```
CA: Command Prompt - mosquitto_sub -h iotrg.jalacomm.id -p 1883 -t "WSX2017/#" -v
```

```
WSX2017/Unit_1 :1,29082017,092732,-6.88853,N,107.61021,E,816.8,45,0.0,28.2,21.7,99,922.9,413,0.329,5671,2.528#
WSX2017/Unit_1 :1,29082017,092833,-6.88853,N,107.61021,E,813.1,45,0.4,28.2,21.7,99,922.9,417,0.327,3049,2.226#
WSX2017/Unit_1 :1,29082017,092934,-6.88853,N,107.61021,E,812.7,0,0.9,27.9,21.1,99,923.0,418,0.327,4302,2.393#
WSX2017/Unit_1 :1,29082017,093035,-6.88854,N,107.61021,E,811.2,45,1.3,27.7,21.1,99,922.9,414,0.328,2944,2.209#
WSX2017/Unit_1 :1,29082017,093136,-6.88854,N,107.61021,E,811.2,0,1.3,27.7,21.1,99,922.9,416,0.328,2076,2.042#
WSX2017/Unit_1 :1,29082017,093237,-6.88853,N,107.61021,E,813.8,0,1.3,27.2,21.1,99,923.0,418,0.327,2268,2.084#
WSX2017/Unit_1 :1,29082017,095155,-6.88854,N,107.61019,E,819.9,45,0.9,16.5,21.1,99,922.8,406,0.331,882,1.652#
WSX2017/Unit_1 :1,29082017,095256,-6.88854,N,107.61021,E,814.1,45,0.9,16.5,21.1,99,922.9,418,0.327,1543,1.903#
WSX2017/Unit_1 :1,29082017,095357,-6.88856,N,107.61021,E,814.2,0,0.9,16.0,21.7,99,922.8,422,0.326,1162,1.774#
WSX2017/Unit_1 :1,29082017,095458,-6.88855,N,107.61018,E,814.1,45,0.9,16.5,21.7,99,922.8,412,0.329,1288,1.820#
WSX2017/Unit_1 :1,29082017,095559,-6.88855,N,107.61018,E,813.5,45,0.9,15.7,21.7,99,922.9,415,0.328,1232,1.800#
WSX2017/Unit_1 :1,29082017,095700,-6.88855,N,107.61020,E,813.5,0,0.4,15.5,21.7,99,922.8,420,0.327,1139,1.765#
WSX2017/Unit_1 :1,29082017,095801,-6.88854,N,107.61019,E,813.0,0,0.4,15.0,21.7,99,922.9,415,0.328,897,1.660#
WSX2017/Unit_1 :1,29082017,095902,-6.88853,N,107.61018,E,815.7,0,0.4,14.5,21.7,99,922.8,414,0.328,1447,1.873#
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```



Compare data with earthnull

Command Prompt - mosquito_sub -h iotgr.jalacomm.id -p 1883 -t "WSX2017/#" -v

```
WSX2017/Unit_1 :1,29082017,092732,-6.88853,N,107.61021,E,816.8,45,0.0,28.2,21.7,99,922.9,413,0.329,5671,2.528#
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WSX2017/Unit_1 :1,29082017,100912,-6.88854,N,107.61015,E,812.1,0,0.4,9.1,22.2,99,922.9,414,0.328,1224,1.797#
```

CO2
400
ppmv

CO2
414
ppmv

Bandung

<https://earth.nullschool.net/#current/chem/surface/level/overlay=co2sc/orthographic=-255.00,0.00,1112/loc=107.698,-6.763>

Date | 2017-08-29 02:30 Local ⇌ UTC
Data | Wind + Carbon Dioxide Concentration @ Surface
Scale |
Source | GEOS-5 / GMAO / NASA
Control | Now « - < - > - » ⊕ Grid ▶ HD
Mode | Air - Ocean - Chem - Particulates
Overlay | CO₂sc - CO₂sc
| SO₂sm
Projection | A - AE - CE - E - O - P - S - WB - W3

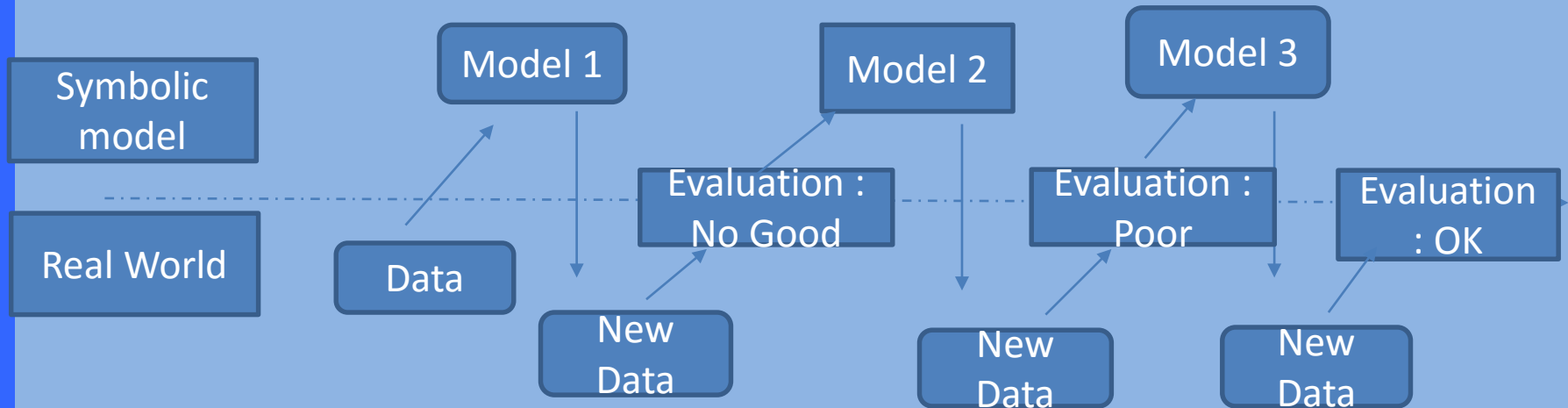


Testing on the field

- Testing in Near Oil Palm Plantation
 - Target in 5 Province
 - Riau
 - South Sumatra
 - West Kalimantan
 - Central Kalimantan
- Measure on reliability of the data and system



Model vs real world



The decision making process. Design for Decision by Irwin Bros, 1953 by Macmillian



Community Engagement and Support

- Government Support
 - Ministry of National Education
 - Ministry of Forestry and Environment
- University Support
 - Weather Modelling
 - Sekolah Bebas Asap (Reduce pollution index in Classroom)
- Community Support
 - Schools and Universities
 - Indonesia bebas asap (Smoke-Free Indonesia)



Background

- The smoke from wildfire in Sumatra and Kalimantan (peat land)
- The effect of the fire in Foresty effected untill more than 300 km from the source
- For example ; the source from the fire in South Sumatra and the effect of the smoke , CO and particulate matters (PM) until West Sumatra
- When haze came , school dismissed the students. This dangeorus because they do not come to safe places
- Several researcher from ITB initiatives to build safe class in class and building the haze protection system



Principle

Haze protection System

TERBUKTI
(Proven)

Reduce air polution Index

MUDAH
(Simple)

Simple implementation and maintenance

MURAH
(Cost effectiveness)

Cheap mateial , easy to install

EDUKASI
(Education)

The education's media for pupil /students

MUMPUNI dan KONTINYU
(Reliable and Sustainable)

Can be used continuously after the smoke problem is finished



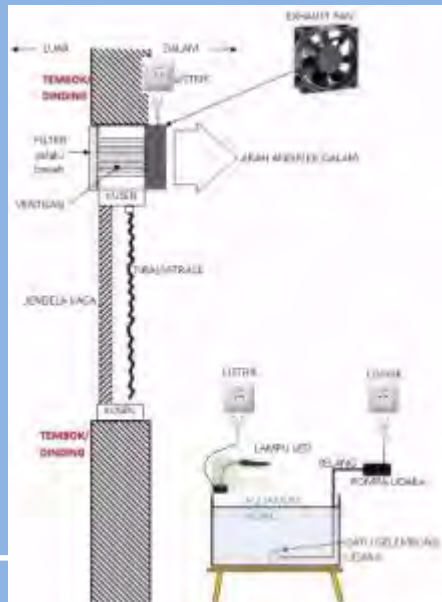
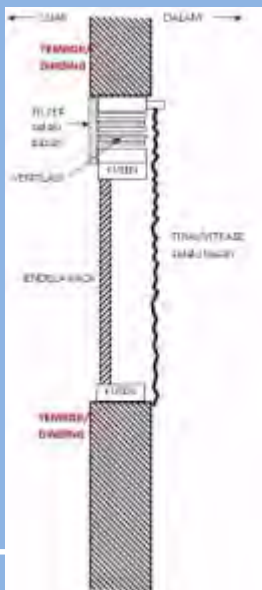
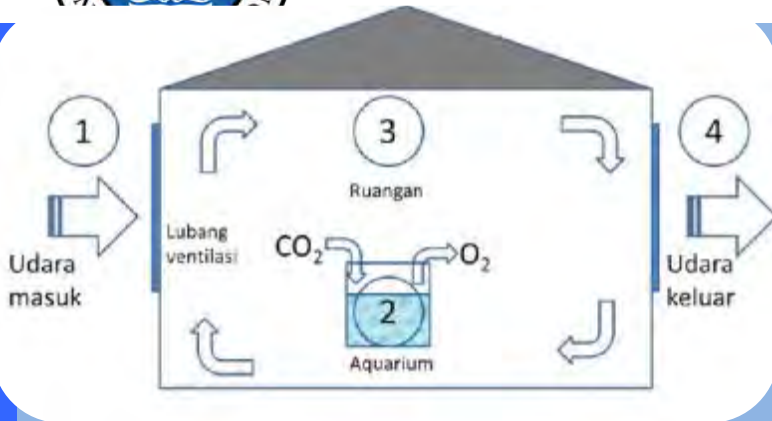
Trial

Location : SD Percobaan – Kota Padang
timeline : 27 – 28 Oktober 2015





Installation system







Results

- Reduce Air Pollution Index (PM)
 - ✓ Index on City (Padang) = 288
 - ✓ Index on the class room after installation = 78





President visited to School





Main Challenges (Future)

- Data sharing
 - Data are available only in web based information systems
 - Need to develop web services to make those data available to others
 - <http://weather.meteo.itb.ac.id/aws.php> is one example that have some of their data available to others using web service (by request)
- Build the model for reduce impact on Disaster
 - Fire on Forestry / Land fires
 - CO/CO2 models
 - PM (Particulate Mattes 2.5 micron)
- Build the Sensor Network
 - AWS (Automatic Weather Station)
 - Carbon Monoxide (CO)
 - Carbon Dioxide (CO2)
 - Particulate Matter
 - Methane
- Simuation on Environment impact peoples
- Build the collaboration with other parties
 - Gov , Academia, and Community



Thank You